

Mobile Retinal Screening in Britain

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Introduction

The first National Workshop on Mobile Retinal Screening (October 1994) for the United Kingdom was largely concerned with differences in organization required to run the screening services in health districts of widely differing characteristics. A description of these differences and of the early results of screening have recently been published.¹ The continuing success of mobile screening units, and rapid developments in available technologies led to the need for a Second National Workshop. This brief report summarizes the presentations given at the Workshop held in April 1997 and lists the major points to arise in the discussion which followed each talk. Although held with UK service provision in mind, the messages may be helpful to other countries where eye screening in diabetes is still in development.

BDA Guidance Document on Retinal Screening

The British Diabetic Association had requested the production of a practical guidance document on how to set up a photography-based screening service for diabetic eye disease. This is to be circulated with a sister document dealing with screening programmes based in optometry services. Professor Taylor (Consultant Physician, Newcastle) reported that a working party had drawn up the 'how to do it' document in respect of photography-based screening methods.

Among the principal considerations laid out in the document, the importance of regarding assessment of the retinae as part of the overall management of diabetes in care for an individual was emphasized and that care for an individual should ideally be co-ordinated in one centre (hospital diabetes centre or general practice). The impact of retinal screening in a health district is likely to be

maximized only when it is linked to a district diabetes register to ensure complete ascertainment and screening. In planning a district eye screening service, the support and collaboration of one or more of the local ophthalmologists was identified as being essential.

The guidance document laid out the step-by-step considerations involved in setting up a screening service *de novo*. Examination of the financial cost of mobile retinal screening services indicates that this is a cost-effective screening method, with a cost of screening one patient varying between £7.50 and £19.00, and the cost of detecting one patient requiring laser therapy being approximately £1000.

The aspect of the guidance document emphasized most strongly was that dealing with the need for continuing audit of the screening process. No matter how good the published results on previous surveys, there will remain a critical need to evaluate continuously the efficiency and effectiveness of the service provided. In order to achieve this, it was recommended that a proportion of all people screened should be examined by a consultant ophthalmologist using a slit lamp, this being the practical approximation to a 'gold standard' method of screening.

Discussion

- The major item which attracted discussion was that of continuing audit of screening performance. Opinions varied on the percentage of people requiring to be examined by ophthalmologists. It became clear that a distinction had to be drawn between gathering adequate information in the course of a single year to establish sensitivity and specificity (which could require at least 20 % of patients to be audited) and maintaining a continued monitoring of the performance of the service over a period of several years. For a health district with 5000 diabetic patients being screened annually, a 5 % sample would require approximately 5 patients per week to be evaluated by a consultant ophthalmologist. This was considered to

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be easily feasible by the ophthalmologists present. The matter was revisited later (see below).

- The need for the BDA guidance document to be disseminated to appropriate individuals within each health district in the UK was highlighted. It was clarified that the document will be sent both to the LDSAGs (Local Diabetes Service Advisory Groups—multidisciplinary bodies recommended by the BDA to advise on local needs for diabetes services) as well as the responsible consultants in public health.

National Survey of Methods for Retinal Screening in Diabetes

Dr Hepburn (Consultant Physician, Hull) reported that a postal survey was used to identify details of organization and funding of the retinopathy screening services in England and Wales. Responses were received from 150 units (response rate 61.7%); 9.3% of units had no systematic retinal screening in place; 24% used community or hospital-based retinal photography; 36% used optometrists with a standardized protocol and a further 29% used opticians in the absence of such a protocol; 12.7% of units relied upon research funding or charitable funding to provide the service, with health service funding supporting most units.

Discussion

- It was agreed that the results were likely to be biased towards units interested in retinal screening, and hence the true national picture was likely to be worse than suggested by the survey. If 10% of the population were not covered by proper screening services, at least 100 000 people with diabetes live in districts in Britain where structured retinal screening is not set up.
- As diabetes remains the leading preventable cause of blindness in adult life in Britain, it should be recognized as an important public health issue. Continued pressure both locally and nationally was suggested to be necessary to ensure that effective action will be taken over the next few years.

Quality Control of the Screening Process

A continuing and welcome growth in the number of retinal screening programmes was noted. The two main approaches involve either some form of retinal photography or examination by optometrists. There are many operational variations between various screening schemes. Dr Greenwood (Consultant Physician, Norwich) pointed out that as there are still no generally agreed performance standards, it is impossible to compare these approaches in order to ensure that individual programmes have adequate sensitivity and specificity and also to determine the most cost-effective screening strategy. There is general agreement that a national Quality Assurance Programme

is urgently needed. In order to develop such a programme, it will be necessary to revisit the performance standards published after the first workshop in 1994:

1. Screening should cover the whole of the designated population.
2. Individuals should be screened at intervals of no more than 12 months.
3. Method used should have a sensitivity of > 80%.
4. Method used should have a specificity of > 95%.
5. Technical failure rate should be < 5%.
6. Basic cost of screening should be < £15 per patient.
7. Cost of true positive should be < £1500 per case.
8. 5% of photographs to be audited externally each year.
9. Outcome of referrals should be audited.
10. Incidence of new visual impairment and blindness should be recorded.

If these standards are agreed, then the next step will be to agree a common reference or 'gold' standard against which to measure the performance of individual screening programmes. Established and accepted standards such as 7-field stereophotography are not practicable for most centres. What is needed is some sort of achievable 'working' standard. This could involve the use of a local ophthalmologist 'accredited' in the assessment of diabetic retinopathy. He/she would regularly check samples of screen positive and screen negative patients. This would allow estimation of the sensitivity and specificity of individual programmes for audit purposes. In addition, 5% of all the photographs could be 'double read' either by a consultant ophthalmologist or a retinal grading centre in order to provide continuous quality assurance of photograph assessment. These proposals will be put to the Royal College of Ophthalmologists and Physicians with the suggestion that a joint working party be set up to address these and related issues.

Discussion

- The practical matter of persuading patients to attend for a second examination was discussed. Careful advice would be necessary to reassure patients who have already been told that their eyes appear to be normal.
- Difficulty in establishing the true rate of development of visual impairment or blindness due to diabetes was noted. There is a clear need for collection of information in each region.

Do Digital Retinal Cameras Represent a Step Forward?

Dedicated digital retinal cameras have recently become available, which allow retinal images to be displayed immediately on a high-resolution computer monitor. Dr Owens (Consultant Physician, Penarth) reported on a pilot

study which showed good agreement between digitized retinal images (in Kodak photo CD format and viewed on a computer monitor) and the original images (viewed as 35 mm slides) when grading DR. Exact agreement was obtained in 83.3 % of images graded, in only four cases was STDR undergraded from the digitized images as non-sight threatening (NSTDR), although these patients would not be lost to follow-up.

More recently, a dedicated digital retinal camera (the Canon CR5 45NM with Sony DXC 95P 3-chip video camera running Frost Medical Software) was compared with 35 mm colour transparencies against the reference 'gold' standard of 7-field 300 stereoscopic retinal photography. There was 93.3 % agreement with only three eyes showing STDR undergraded as NSTDR from the digital images when compared to the colour transparencies. Compared to the 35 mm colour transparencies, the resolution of the system was relatively low (785 × 575 pixels). However only very small or low contrast retinal lesions, such as some microaneurysms or very early new vessels, were difficult to grade.

Another benefit of the digital camera is its much lower intensity flash during photography (around one-twentieth of that required for a colour transparency). This resulted in less discomfort for the patient and made it easier to acquire repeated photographs.

Discussion

- The greater patient comfort as a consequence of the lower intensity flash required for image acquisition was regarded as a positive benefit, even though patients presently tolerate the bright flash required for ordinary photography without complaint.
- The rapidly developing technology underpinning this technique was acknowledged. Even though image quality was adequate for the purposes of screening, further developments both in image enhancement and the possibility of handling the data could be anticipated.

Value of Visual Acuity Measurements in Screening for Treatable Diabetic Retinopathy

Treatment for diabetic maculopathy is based on identification of clinically significant macular oedema (CSMO). This requires binocularity for appreciation of retinal thickening. Since neither standard photography nor direct ophthalmoscopy provide stereopsis it is necessary to utilize other parameters to indicate the presence of CSMO. Widely accepted indicators are the presence of exudates within 1 disc diameter of the foveola or a reduction in the visual acuity.

Dr Broadbent (Consultant Ophthalmologist, Liverpool) reported that in 4261 consecutive patients attending for community-based screening 914 (21 %) had reduced visual acuity (< 6/9), of which 42 had reduced visual

acuity and CSMO in at least one eye. Of these CSMO patients 41/42 (98 %) had an exudate in at least one eye.

Visual acuity measurement detects CSMO but is not specific. It will detect cataract and age-related macular degeneration but is this our purpose in screening? Exclusion of visual acuity measurement could save money in terms of reduced personnel and increased throughput. Data on visual loss in diabetes is important but do we need to collect this data before the patient develops sight threatening diabetic eye disease? It may be that the additional cost of measurement of visual acuity needs to be justified on other grounds. Also, alternative methods of detecting CSMO in screening for maculopathy need to be investigated, such as photographic stereomacular pairs, slit-lamp biomicroscopy, scanning laser ophthalmoscopy or digital imaging.

Discussion

- The difficulty in obtaining accurate visual acuity data was considered. The need for adequate training and accreditation of the individual expected to perform this measurement was felt to be often overlooked. Use of the more accurate Bailey-Lovie Logmar chart rather than the standard Snellen chart was discussed.
- The detection of other treatable eye disease, e.g. cataract, could be an associated result of performing VA measurement.
- The value of sequential visual acuity data was discussed. The justification for measurement of visual acuity in detecting maculopathy was not immediately demonstrable but most physicians regard it as self-evident. However, a previous clear baseline was felt to be helpful in assigning appropriate importance to the observation on any one day.

Line of Responsibility for Reporting upon Retinal Findings

Responsibility for proper conduct of retinal screening is usually regarded as being vested in the doctor primarily responsible for the patient or the consultant diabetologist responsible for the screening programme. Professor Taylor (Newcastle) discussed the need to identify the line of responsibility for notification of significant abnormalities identified. Retinal screeners should be expected to be trained to an appropriate level.

Provided that the retinal screener had carried out the normal procedure as laid down for the screening unit, it was recognized as being most unlikely that the screener could be ascribed any blame in the potential matter of any complaint about serious retinopathy being missed. NHS indemnity would apply in such circumstances.

Discussion

- Clarity must be achieved in the intended process for identification and referral with appropriate speed

of people who meet the local agreed criteria for examination by ophthalmologist.

Collaboration between Camera-based Screening and Optometry-based Screening

Dr Simpson (Consultant Physician, Reading) reported that a formal Diabetic Eye Screening programme using optometrists was established in West Berkshire in 1983 and the mobile camera unit was added to the service in 1992. The Programme was inaugurated and run by the Eye Department until 1996, when it moved to the Diabetes Centre. The database is held on card index, updated from GP registers, and holds information on approximately 6500 people in a catchment population of 490 000.

The service is organized by an Eye Screening Clerical Officer, who works 25 hours per week. Patients are mailed annually unless they are under active follow up in the Eye Department, or have been screened within the past year by the mobile camera. They are requested to attend an optometrist and a form is enclosed for the optometrist to complete and return to the Eye Screening Clerk. If an optometrist requests ophthalmological referral, the clerk arranges this via the hospital PMS, categorizing the referral as urgent (within 1 week), priority (within 6 weeks) or routine.

A recent audit found that 85 % of people responded to the mailing by attending an optometrist. Of all those attending for eye screening (not under follow-up in the Eye Department), 65 % were screened by an optometrist, 25 % by the mobile camera, and 10 % by their GP.

A better diabetic eye screening programme might include annual retinal photographs and an examination by an optometrist, the two methods being complementary. However, with West Berkshire's large catchment population this is currently unrealistic with current resources and the aim is to provide screening by photographs or optometrist on alternate years.

The programme as it stands is far from perfect and can be criticized for being card index-based, not being linked to the Health Authority registry, the relatively high failed response rate of 15 %, and for lacking robust audit. On the other hand, it has the advantage of simplicity, is run by a dedicated Eye Screening Clerical Officer, is universally accepted by GPs and popular with patients.

Discussion

- The need to co-ordinate whatever screening activity is taking place in a district was emphasized.
- The utility of accepting that more than one modality of screening would be required in any given health district was widely accepted.

Summary

For the estimated 100 000 people with diabetes who live in the Health Districts of England and Wales without organized retinopathy screening much work remains to be done to ensure that they do not suffer visual loss. A concerted effort by those responsible for Public Health would appear necessary, and this may become more likely as it is realized that screening for diabetic retinopathy offers the best value for money of any screening programme. Hopefully recognition of the human cost of blindness will also persuade of the need for action. Although the impact of systematic screening by any method is a vast improvement upon no screening at all, there remains a need to optimize current screening programmes, particularly by use of ongoing quality assurance schemes. The details of how screening is carried out will continue to attract considerable debate, with organizational issues and use of digital camera technology being current hot topics.

The bottom line of the workshop was not controversial: screen everyone somehow, but gather objective data.

Acknowledgements

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References

1. Taylor R. Practical retinal screening using the mobile retinal camera: Report of a 12 centre study. *Diabetic Med* 1996; **13**: 946–952.